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WEST VIRGINIA
AGRICULTURAL EXPERIMENT STATION,
MORGANTOWN, W. VA.

BULLETIN 61.

SEPTEMBER, 1899.

Sheep Feeding Experiments.

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BY J. H. STEWART AND HORACE ATWOOD

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[The Bulletins and Reports of this Station will be mailed free to any citizen of West Virginia upon written application. Address Director of Agricultural Experiment Station, Morgantown W. Va.]

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MORGANTOWN:
NEW DOMINION STEAM PRINTING HOUSE,
1899.

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Sheep Feeding Experiments.

A large proportion of the lambs which are raised in West Virginia for the production of mutton, are marketed in the fall, and although this is undoubtedly the simplest way of disposing of the surplus lambs, yet this practice possesses some serious defects, for when animals of any kind are constantly being sold from a farm, with now and then some hay or grain, the fertility of the soil is continually carried away, and unless commercial fertilizers are employed to supply the deficiency of potash and phosphoric acid, the productiveness of the land must constantly diminish. On the other hand, if these lambs can be profitably fattened during the winter, they may be made to consume the clover hay, or other coarse fodder of the farm which has only a small commercial value. Also the farmer is enabled to feed his grain at home instead of being obliged to draw it several miles to the railroad station. In addition to the grain which is raised upon the farm, some of the concentrated feeding stuffs, such as cotton seed meal, linseed meal, or wheat bran, can generally be used to advantage in the fattening ration, and as each of

these materials contains a large quantity of nitrogen, phosphoric acid, and potash, which is recovered in the manure, it is seen that when the policy of feeding the lambs during the winter is intelligently carried out, that the land will gradually become richer instead of poorer, because more fertility will be added by the manure than is carried away by the lamb crop.

Although the theory is very clear regarding the matter, the practical question arises, can the ordinary farmer in West Virginia actually make a profit by feeding the common, native or grade lambs heavily with grain for eight or ten weeks during the winter, and if this is the case what is the best and most economical grain ration? In order to begin the study of these questions, and acquire some reliable data, a series of experiments were planned, the first of which is here reported.

Twenty lambs and five yearling wethers were secured for the experiment, and as it was late in the season before they were bought, it was found necessary to procure them from four or five different sources, consequently they were not a uniform lot. They consisted of Southdown and Shropshire grades and natives, such as can be found in any section of the state. The yearling wethers, too, were common native sheep.

The lambs, consisting of sixteen ewes and four wethers, were divided into similar lots of ten each, there being two wether lambs in each lot.

Lot I was fed a mixed grain ration, consisting of equal parts of linseed meal, wheat bran, and hominy feed; and Lot II was fed whole corn. The five yearling wethers, or Lot III, received the same grain ration as Lot I. They were fed all the hay they would eat up fairly clean, and each morning the hay remaining in the racks was weighed and subtracted from the amount fed, so the tables show the amount actually consumed. The hay consisted of mixed clover and timothy, and was not of extra quality. It probably would have graded in the market as No. 2 or No. 3 mixed hay.

Each animal was numbered and weighed at the beginning of

the experiment, and at the end of each week thereafter. The feeding extended over a period of eight weeks, and during this time the sheep were kept quite closely confined in a barn.

The following table shows the amount of hay and grain consumed by the different lots during each week of the feeding period, and for the total period:

Week.	Pen I.		Pen II.		Pen III.	
	Hay.	Grain.	Hay.	Grain.	Hay.	Grain.
1	102.1	42	97.4	42	62.1	25
2	121.9	50	101.4	56	93.2	35
3	136.5	58	116.7	58	102.5	35
4	132.3	70	111.8	70	97.2	44
5	112.5	77	106.7	77	87.0	49
6	127.9	77	106.4	77	87.9	51
7	145.9	77	115.9	77	89.4	56
8	158.9	79.5	112.0	79.5	80.3	56.5
Total...	1038.0	530.5	868.3	536.5	699.6	351.5

As has been already stated, the grain consumed by pens I and III consisted of a mixture of equal parts of linseed meal, wheat bran, and hominy feed, and the following table shows the amount and cost of each material consumed by each pen during the entire period. The hay was valued at \$4.50 per ton which was a fair price considering its quality; the corn at 40 cents per bushel; the linseed meal at \$25.00 per ton; the wheat bran at \$15.00 per ton; and the hominy feed at \$14.50 per ton, which was the actual cost price in our retail market.

Table showing the amount and value of the food consumed during the feeding period of eight weeks.

LOT I—TEN LAMBS.

	Amount.	Value.
Linseed Meal.....	176.8	\$2.21
Hominy Feed.....	176.8	1.28
Wheat Bran.....	176.8	1.32
Hay.....	1038.0	2.33
Total.....		\$7.14

LOT II—TEN LAMBS.

Corn.....	536.5	\$3.83
Hay.....	868.3	1.95
Total.....		\$5.78

LOT III—FIVE YEARLING WETHERS.

Linseed Meal.....	117.1	\$1.46
Hominy Feed.....	117.1	.84
Wheat Bran.....	117.1	.87
Hay.....	699.6	1.57
Total		\$4.74

The table shows that the cost of the hay and grain consumed by Lot I was \$7.14; by Lot II, \$5.78; and by Lot III, \$4.74.

The weight of each animal at the beginning of the experiment, and at the end of each week; the total gain made by each animal; and the total weight and gain of the different lots is shown by the following table:

LOT I.

Number of Animal	Original Weight..	First Week.....	Second Week.....	Third Week.....	Fourth Week.....	Fifth Week.....	Sixth Week.....	Seventh Week.....	Eighth Week.....	Total Gain.....
1	79.5	83.2	88.0	85.3	86.0	85.0	87.6	90.7	97.0	17.5
3	83.6	86.6	89.0	88.5	90.0	89.5	90.1	92.6	94.2	10.6
4	71.7	74.6	74.9	77.7	75.0	76.0	76.5	78.4	83.0	11.3
8	74.3	77.8	80.1	80.4	82.0	83.0	81.0	83.1	86.4	12.1
9	70.9	73.8	76.5	75.6	79.4	80.0	79.7	81.3	84.9	14.0
15	90.7	94.3	93.5	96.7	97.9	99.0	99.3	99.1	100.6	9.9
18	85.0	88.5	90.9	90.0	92.9	96.0	95.6	97.7	100.1	15.1
20	96.7	100.2	100.4	103.8	105.4	108.5	104.4	107.5	111.7	15.0
64	66.8	72.8	74.0	75.5	78.8	81.0	82.1	86.0	89.0	22.2
51	66.1	71.6	72.2	74.5	77.2	76.9	78.7	82.4	83.9	17.8
Total..	785.3	823.4	839.5	848.0	864.6	874.9	875.0	898.0	930.8	145.5

LOT II.

Number of Animal	Original Weight..	First Week.....	Second Week.....	Third Week.....	Fourth Week.....	Fifth Week.....	Sixth Week.....	Seventh Week.....	Eighth Week.....	Total Gain.....
5	73.1	76.1	77.9	80.0	81.5	81.5	78.6	78.8	80.1	7.0
6	78.9	80.8	80.2	84.0	85.3	87.5	88.7	90.1	90.8	11.9
10	80.5	84.9	86.0	85.7	91.1	87.4	89.2	91.8	94.8	14.3
11	65.6	70.2	68.9	72.3	74.8	75.0	77.9	80.8	82.5	16.9
12	88.0	92.5	96.8	99.0	100.2	104.5	104.5	109.8	111.5	23.5
13	84.6	85.7	86.0	86.8	87.9	89.0	90.0	92.2	94.3	9.7
14	77.4	83.0	83.4	88.7	88.7	85.0	89.7	93.0	96.4	19.0
16	74.8	76.7	81.6	82.5	84.6	86.5	88.5	89.9	92.7	17.9
17	90.5	93.4	96.0	95.7	97.0	100.7	101.3	104.5	104.4	13.9
19	72.4	76.4	78.5	80.4	83.4	85.9	87.0	87.4	92.6	20.2
Total..	785.8	819.7	835.3	855.1	874.5	883.0	895.4	918.3	940.1	154.3

LOT III.

Number of Animal	Original Weight.	First Week.....	Second Week.....	Third Week.....	Fourth Week.....	Fifth Week.....	Sixth Week.....	Seventh Week....	Eighth Week.....	Total Gain.....
21	108.8	111.9	114.2	113.1	113.0	115.0	117.1	118.0	119.6	10.8
22	121.9	124.5	126.6	126.4	129.0	132.0	132.6	131.3	133.4	11.5
24	115.9	116.7	114.7	117.8	119.0	120.0	119.8	118.0	120.2	4.3
25	105.9	103.8	105.3	107.3	107.4	108.0	109.4	109.9	112.2	6.3
47	119.4	122.7	124.1	124.6	124.3	129.0	131.2	130.6	130.7	11.3
Total ..	571.9	579.6	584.9	589.2	592.7	604.0	610.1	607.8	616.1	44.2

It is seen from the above table that the lambs in Lot I made an average gain of 14.5 pounds; those in Lot II a gain of 15.4 pounds; while the yearling wethers only gained 8.8 pounds each. This table also shows a marked variation in the amount of gain made by the different animals. For example: In Lot I, lamb number 15 gained only 9.9 pounds, while number 64 gained 22.2 pounds. Also in Lot II, number 5 gained only 7 pounds, and lamb number 12 gained more than three times as much. The variation in the amount of gain seemed to be due more to the individuality of the animal than to breed, sex, or the original weight. Number 64, which was one of the smallest lambs at the beginning of the experiment, and apparently one of the common natives, made almost as much gain in live weight as number 12 in Lot II, which made the largest gain of any of them, and which was one of the largest lambs at the beginning of the feeding period.

The wether lambs, Nos. 12, 18, 19, and 20, made an average gain of 18.4 pounds, while the ewe lambs made a gain of only 14.1 pounds, a difference of 4.3 pounds per lamb in favor of the wethers, but of course one should not base any definite conclusion on this result on account of the small number of wether lambs in the test.

Lot I made an increase in live weight of 145.5 pounds, at a cost of \$7.14 or at the rate of 4.9 cents per pound; Lot II gained 154.3 pounds, costing \$5.78, or at the rate of 3.7 cents per pound;

while the yearling wethers gained 44.2 pounds, costing \$4.74, or 10.7 cents per pound. The corn-fed lot, then, made the cheapest gain, and the yearling wethers the most expensive.

For various reasons it is a difficult matter to determine the actual value of the manure produced by the different lots of animals in this experiment. Soils long cultivated usually lack humus, and this is supplied by various means, including stable manure.

In calculating the value of the manure the two very important factors,—the influence of humus upon the physical and chemical properties of the soil, and the addition to it of vigorous, nitrifying organisms, have been left entirely out of view and merely the amount of nitrogen, phosphoric acid and potash contained in the manure has been considered. The amount of these materials has been determined by deducting 10% from the amount of these constituents present in the fodder, for it has been found that fattening animals store up in their systems only about 10% of the amount of these materials present in the fodder.

The following table shows the average percentage composition of the hay and grain used in the experiment. (Handbook of Experiment Station Work, pp. 397-398.)

	Nitrogen.	Phosphoric Acid.	Potash.
Mixed Hay.....	1.66%	.45%	1.55%
Mixed Grain Ration..	3.36%	1.90%	1.16%
Corn.....	1.82%	.70%	.40%

The following table shows the amount in pounds of nitrogen, phosphoric acid, and potash consumed by the various lots and the amount of these constituents remaining in the manure.

FERTILIZING CONSTITUENTS IN FODDER AND MANURE.

LOT I.

	Lbs. of Nitrogen.	Lbs. of Phos. Acid.	Lbs. of Potash.
In Hay.....	17.2	4.6	16.0
In Grain	17.8	10.0	6.1
Total	35.0	14.6	22.1
In Manure (90 per cent)...	31.5	13.1	19.9

LOT II.

	Lbs. of Nitrogen.	Lbs. of Phos. Acid.	Lbs. of Potash.
In Hay	14.4	3.9	13.4
In Grain	9.7	3.7	2.1
Total	24.1	7.6	15.5
In Manure (90 per cent) ..	21.6	6.8	13.9

LOT III.

	Lbs. of Nitrogen.	Lbs. of Phos. Acid.	Lbs. of Potash.
In Hay	11.6	3.1	10.8
In Grain	11.8	6.6	4.0
Total	23.4	9.7	14.8
In Manure (90 per cent) ..	21.0	8.7	13.3

The following table shows the value of the manure made by the different lots of animals during the experiment. The values used are those which were adopted by this station in computing the relative commercial value of fertilizers and which represent, as nearly as can be estimated, the prices at which the respective ingredients were retailed to farmers. It must not be overlooked however that these figures are used only as a convenient basis for calculating the above values for in all probability they do not truly represent the actual value of these fertilizers.

Nitrogen, - - - 17 cents per lb.

Phosphoric Acid, - 4 " "

Potash, - - - 5 " "

VALUE OF MANURE

	N.	P ₂ O ₅	K ₂ O.	Total.
Lot I	\$5.35	\$0.52	\$0.99	\$6.86
Lot II	3.67	.27	.69	4.63
Lot III	3.57	.34	.66	4.57

We now come to the all important question as to whether we made a profit or suffered a loss by feeding the lambs and wethers.

The lambs cost us at the beginning of the experiment, 4½ cents per pound, and they were sold for 4¾ cents. The yearling wethers cost 4 cents per pound, and were sold for the same price per pound that was given for them. Most farmers in the state, however, could have purchased, in lots of 100 or more,

lambs equally as good as we bought, for 4 cents per pound, and undoubtedly a car load of lambs as fat as ours, could have been sold for at least 5 cents per pound, because fat lambs at the close of the feeding period, were selling in Pittsburg at \$5.75-\$5.80 per hundred. In calculating our profit, we have taken into consideration, however, what the animals actually cost us, and what they sold for in our local market.

The following table shows the cost of the different lots; the cost of the food consumed; the selling price; the value of the manure; and the profit from each of the three lots.

	Original Cost.	Cost of Fodder.	Total Cost.	Selling Price.	Value of Manure.	Total Value.	Profit.
Lot I.....	\$ 35.33	\$ 7.14	\$ 42.47	\$ 44.21	\$ 6.86	\$ 51.07	\$ 8.60
Lot II.....	35.36	5.78	41.14	44.65	4.63	49.28	8.14
Lot III.....	22.87	4.74	27.61	24.64	4.57	29.21	1.60

By taking into account the value of the manure, it is seen that we made a profit on all three lots, but in the case of the yearling wethers, this profit was very small, and if the value of the manure is not taken into consideration, they were fed at an actual loss.

If we assume that the manure merely pays for the care of the stock during the fattening period, then we still made a profit of \$1.74 in the case of Lot I; \$3.51 by feeding Lot II; and a loss of \$2.97 in the case of the wethers, or calculating this for 100 animals in each flock, \$17.40 for Lot I; \$35.10 for Lot II; and a loss of \$59.40 for Lot III.

The corn-fed lot brought us in more clear money; but the manure from the lambs fed the nitrogenous ration was so much more valuable that the two lots gave practically the same profit. Perhaps better results might have been obtained if a small quantity of the linseed meal had been added to the whole corn ration.

Although definite conclusions should not be drawn from one experiment, yet this feeding test indicates that lambs can be fattened more profitably than yearling wethers, and that under favorable conditions, it may be better for farmers who have an abundance of coarse fodder, to feed their lambs heavily for eight

or ten weeks, instead of selling them at the usual time in the fall.

It also indicates that forage and grain produced upon the farm may be sold at home for a higher price than the market offers.

SECOND SHEEP FEEDING EXPERIMENT.

This experiment was planned as a continuation of the preceding one. Sixty lambs were procured in the fall of 1898 and divided into four lots of fifteen each. Lot I was fed timothy hay and shelled corn. Lot II received timothy hay, and a grain ration consisting of equal parts of oil meal, hominy feed and bran. Lot III was fed cow pea hay and shelled corn, and lot IV received cow pea hay and the same grain ration as Lot II.

In none of the different lots were the gains satisfactory, and it was finally found that nearly all of the lambs were seriously affected with an intestinal parasite which will be described fully elsewhere. The experiment was discontinued after several of the lambs had died from this cause. That cow pea hay is superior to timothy was clearly shown, however, for the two lots receiving cow pea hay made a gain of 76 pounds, while the other two lots receiving timothy hay gained only 5.7 pounds.

NOTICE.

Applications for bulletins of this Station should be addressed to the Director of the West Virginia Agricultural Experiment Station, Morgantown, W. Va.

(The bulletins named below are available for distribution.)

- No. 4. The Creamery Industry; Its Adaptability to West Virginia.
- No. 5. The Selection of Milch Cows.
- No. 6. Six Months' Experience in Running a Creamery; Improved Process of Handling Cream and Churning.
- No. 12. The Canada Thistle.
- No. 14. Farm and Garden Insects and Experiments with Remedies; Notes of the Season.
- No. 15. Raspberry Gouty-Gall Beetle.
- No. 16. Yellow Locust, Insect Ravages upon.
- No. 17. Black Spruce, Insect Ravages.
- No. 19. Your Weeds and Your Neighbor's, Part 1. Weeds as Fertilizers.
- No. 20. Potato Culture and Fertilization, Tests of Some Varieties of Tomatoes.
- No. 21. Injurious Insects and Plant Diseases.
- No. 25. Plat Experiments with Commercial Fertilizers on Wheat.
- No. 26. Inspection of Commercial Fertilizers.
- No. 27. Notes on Pruning.
- No. 28. Plat Experiments with Commercial Fertilizers on Corn.
- No. 29. Experiments with Potatoes at the Station. Experiments on Corn at the Out-Stations.
- No. 30. Address and Notes on Sheep.
- No. 33. Sub-Irrigation in the Greenhouse.
- No. 38. Potato Blight, Potato Scab.
- No. 40. Commercial Fertilizers.
- No. 42. Vegetables.
- No. 43. When, Why, What and How to Spray.
- No. 44. Practical Entomology.
- Special Bulletin No. 2. Proceedings connected with the celebration upon the completion of the Station Building and the Organization of the Sheepbreeders and Wool-Growers' Association and the State Horticultural Society.
- Third Annual Report, 1890.
- No. 51. Commercial Fertilizers Jan. '98.
- No. 52. Strawberries.
- No. 53. Commercial Fertilizers Dec. '98.
- No. 54. Nursery Hints.
- No. 55. Sugar Beet Investigation.
- No. 56. Report on Spruce and Pine Investigation.
- No. 57. Commercial Fertilizers.
- No. 58. The Effect of Pressure in the Preservation of Milk.
- No. 59. Whole Corn Compared with Corn Meal for Fattening Hogs.
- No. 60. Poultry Experiments.

